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Native or Invasive? The Red-Haired Pine Bark Beetle *Hylurgus ligniperda* (Fabricius) (Curculionidae: Scolytinae) in East Asia

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Abstract: The red-haired pine bark beetle, *Hylurgus ligniperda* (Fabricius), is one of the most rapidly spreading invasive forest insects. Originally from Eurasia, it has subsequently been introduced to Oceania, North, and South America. Yet, the status of *H. ligniperda* in East Asia is ambiguous. Here, investigation and analysis were conducted on the beetle in China, South Korea, and Japan. New occurrences in China and South Korea were recorded by field surveys and the expansion of *H. ligniperda* spreading in East Asia was analyzed. The results show that *H. ligniperda* is likely an invasive species in East Asia, initially invading Japan, then South Korea. Now it has invaded and successfully colonized Shandong province, China. Furthermore, the species has spread rapidly and it is now widely distributed in South Korea and Japan.

Keywords: pine; *Pinus*; invasion track; new distribution; alien; trap

1. Introduction

The red-haired pine bark beetle, *Hylurgus ligniperda* (Fabricius), is a well-known forest insect that colonizes the phloem of pine species [1,2]. It can attack stumps, freshly cut logs, and stored timber [1]. In some areas, *H. ligniperda* has become a predominantly root-dwelling species that usually bores into the host through the soil. Overwintering adults have been observed feeding on the root collars of 1–2-year-old seedlings [3,4].

Usually *H. ligniperda* does not kill trees and is considered a secondary pest. Part of the damage is mechanical and direct through brood galleries and feeding tunnels formed under the bark. Decay or sap stain fungi can also be introduced indirectly, which can reduce the quality and value of logs [5,6]. Blue stain fungi, *Leptographium* spp. (Ascomycota: Ophiostomatales), were found transmitted from beetles' galleries into the wood [3,7,8]. In New Zealand, the main damage by *H. ligniperda* in plantation forests is from wood-staining and decay fungal associations that enter with the adults into the brood galleries, and as a quarantine pest that may necessitate treatment of export logs and timber, which greatly increases the cost of exports [5].

Previously, when researchers recorded the original distribution, it included Europe, Russia, the Mediterranean area, and the nearby Atlantic Ocean islands. It was also reported as introduced to South Africa, Japan, South Korea, Sri Lanka, Australia, New Zealand, USA

(NY and CA), Brazil, Uruguay, and Chile [1,9–12]. It should be noted that the distribution of *H. ligniperda* in East Asia is ambiguous in literature. Wood and Bright [9] recorded the distribution of *H. ligniperda* as "Asia ('Manchuria' in China/ Japan)". Hoebeke [13] wrote "It is native to Eurasia and north Africa" and "introduced to Japan". Kim [8] only stated "It is native to Europe" without referencing Asia. CABI [12] listed that "native to Asia (China/Turkey)" and "Japan is invasive", which is reference to a misquotation of "Wood and Bright (1992)". So, whether *H. ligniperda* is native to Asia is still unclear.

In this paper, we aim to clarify the history of recorded collections and known records of *H. ligniperda* in East Asia (Japan, South Korea, and China) using new survey results. Our aim is to determine the status of the insect in East Asia based on the limited collection data. We tested whether the museum specimens and the new records conform to the scenario of native but rarely reported insect (old samples, widely distributed), or whether they conform to the scenario of recent introduction and rapid spread.

We present new records in China and South Korea. The updated distribution in East Asia will contribute to status as an introduced or native species that directly relates to its control and management.

2. Materials and Methods

The new occurrences in China and South Korea were recorded by field surveys from 2013 to 2020. In China, traps were set initially to monitor pine pests in several provinces (Table 1). The lures include pine resin, α-pinene, monochamol, ipsenol, or ipsdienol. After *H. ligniperda* was first found in Shandong, two wood borer pest surveys that focused on damage of pine wood nematode *Bursaphelenchus xylophilus* were processed in Yantai and Weihai. Coincidently, more *H. ligniperda* were found. All those records were included. In Korea, nine sites were surveyed with a lure using a funnel trap. The lures were either alcohol + α-pinene or ipsenol + monochamol.

Table 1. Survey of *Hylurgus ligniperda* in China and Korea in this study.

Country	Location	Periods of Time	Methods [1]	Number of Traps	Number of *H. ligniperda*
China	Fu'an, Fujian prov.	September–October 2018; June–October 2019	trap and search	10–12	0
China	Fuzhou, Fujian prov.	May–August 2018; June–September 2019	trap and search	5	0
China	Zhuhai, Guangdong prov.	2018–2020	trap and search	4	0
China	Shenzhen, Guangdong prov.	2016–2017	trap and search	4	0
China	Kunming, Yunnan prov.	May–August 2019	trap and search	6	0
China	Xishuangbanna, Yunnan prov.	June–August 2014	trap and search	5–8	0
China	Taian, Shandong prov.	July–August 2019	trap and search	9	4
China	Yantai, Shandong prov.	October 2020	search	N/A	10
China	Weihai, Shandong prov.	October 2020–June 2021	search	N/A	20
Korea	Heuksan Island, Jeollanam-do	N/A	trap	N/A	0
Korea	Wando-gun, Jeollanam-do	N/A	trap	N/A	0
Korea	Sacheon-si, Gyeongsangnam-do	N/A	trap	N/A	0
Korea	Gwangju-si, Gyeonggi-do	N/A	trap	N/A	0
Korea	Sangju-si, Gyeongandbuk-do	March–October 2018; March–October 2019	trap	20	53
Korea	Yanggu-gun, Gangwon-do	April–October 2017; February–October 2020	trap	5–10	27
Korea	Inje-gun, Gangwon-do	April–October 2017; May–August 2019	trap	5–12	25
Korea	Chuncheon-si, Gangwon-do	March–September 2018; February–April 2020	trap	3–5	29
Korea	Boryeong-si, Chungcheongnam-do	April–October 2013	trap	45	118

[1] The attractants of funnel trap are alcohol with α-pinene or ipsenol + monochamol in China, and *Monochamus* longhorn beetles pheromone with α-pinene in Korea.

The known localities of *Hylurgus ligniperda* in Japan were gathered from literature, herbarium records, and observations.

The new collected beetles were firstly identified by comparing the external morphological features with published articles [11] and reference collection specimens from the Bark Beetle Academy (http://ambrosiasymbiosis.org/academy, accessed on 5 May 2021). Specimens from China and Korea are deposited at the University of Florida (USA), Shandong Agriculture University (China), and Research Institute of Forest Insect Diversity (Korea). The annotated maps were created in ArcMap 10.4.1.

Samples from China (Weihai and Yantai) and Korea (Buyeo-gun) were sequenced. DNA was extracted using the SDS-based DNA extraction method [14]. We amplified and sequenced the partial cytochrome oxidase I (COI) with the primers LCO 1490 and HCO 2198 [15], and the nuclear large ribosomal subunit (28S) using the primers S3690F and A4285R [16]. Reads were assembled using Geneious® 9.1.8 (www.geneious.com, accessed on 25 June 2021). Sequences were then used to search the databases GenBank (www.ncbi.nlm.nih.gov/genbank/, accessed on 25 June 2021). Also, the sequences for COI and 28S were deposited in GenBank (Supplementary material Table S1; MZ562956–MZ562958, MZ565500).

3. Results and Discussion

Eight new sites of the *H. ligniperda* in Asia were included, three from China and five from Korea (Table 1).

All three sites in China are located within Shandong province (Taian, Yantai, and Weihai city; Figure 1, Supplementary Material Table S1). The earliest record is from Culai Mt., Taian, Shandong in 2019. Bottle traps with lure (slash pine resin) were set in the pine plantation. The host plant of *H. ligniperda* in Culaishan Forest Farm, Taian is unclear as the beetles were only captured in lure traps. Whereas, there are four pine tree species present at the farm, *Pinus tabuliformis* Carrière, *P. thunbergii* Parl., *P. densiflora* Sieb. et Zucc., and *P. armandii* Franch. One more sample was found from an unknown fallen branch in nearby mountain in 2020 (Supplementary Material Table S1). In Yantai and Weihai, all samples were collected from stumps of *P. thunbergia*, which are all under the attack of pine wood nematode. More than 15 stumps were peeled and dissected, and all were infested by *H. ligniperda.* Reports of *H. ligniperda* attacking these native trees in Shandong constitute the first natural occurrences recorded in China.

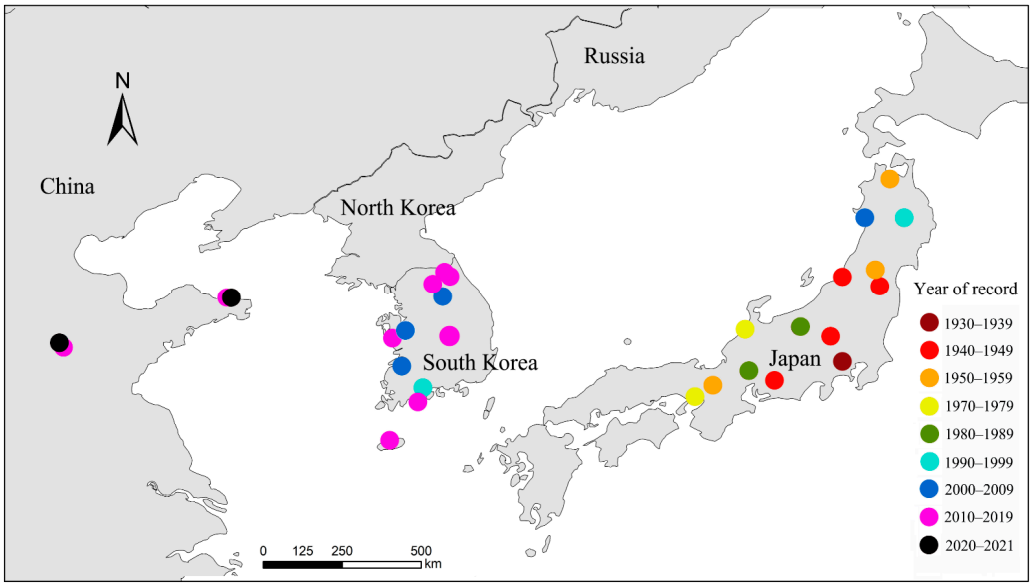

Figure 1. Invasion track of *Hylurgus ligniperda* in East Asia.

Park et al. [11] first recorded *Hylurgus ligniperda* in Korea based on deposited specimens in several institutes. After checking the survey results for wood-boring beetles, more samples were found from lure traps in five locations at various sites between 2013 to 2020

(Table 1, Supplementary Material Table S1). In areas such as Boryeong-si in 2013, Inje-gun in 2017 and 2019, Yanggu-gun in 2017 and 2020, Sangju-si in 2018–2019, and Chuncheon-si in 2018 and 2020, a total of 252 *H. ligniperda* specimens were captured. In South Korea, the suspected first individual was captured in Jeollanam-do in 1999 [11]. Before 1999, several forest surveys had been conducted with a focus on bark beetles in local fauna, but no *H. ligniperda* were found [17,18]. The lack of collections during this period is problematic. Possible scenarios include the beetle not being present, the beetle being undetected at low populations, or the survey methods may not be ideal for capture, such as seasonality or flight time. After 1999, *H. ligniperda* quickly made a spread to nearby regions in Korea, suggesting an expanding nascent population was present at this time.

In Japan, the first record of *H. ligniperda* was in "Yokoyama village, Tokyo" in 1935 [19]. After that, 13 other occurrences were recorded in Honshu Island (Figure 1). The occurrences and times were as follow: Niigata, 1948 [20]; Aichi, 1949 [20]; Fukushima,1949 [21]; Gunma, 1949 [21]; Aomori, 1950 [21]; Yamagata, 1953 [22]; Kyoto, 1954 [21]; Hyogo, 1970 [23]; Ishikawa, 1970 [24]; Gifu, 1984 [25]; Nagano, 1986 [26]; Iwate, 1992 [27]; and Akita, 2001 [28]. The high frequency and large scale of surveys conducted prior to 1940 give little doubt that the beetle is invasive in Japan [19,29–31]. Since the first record of *H. ligniperda* in 1935, it had spread to the north and south of Honshu by 1950. The host of *H. ligniperda* in Japan is *Pinus* spp., such as *P. densiflora* Siebold & Zucc, and *P. thunbergii* Parl. Takahashi [28] reported that *H. ligniperda* were captured by a lure trap (pinene and ethanol) in Japanese pear (*Pyrus pyrifolia* Nakai) orchards.

Because there are only limited reference sequences in NCBI and we only have sequences from Asian samples, we do not provide the genetic population analysis at this time. However, Chinese samples are 100% identical to Korean samples in COI with the closest matching sequence on NCBI being *H. ligniperda* from New Zealand (COI: HM002621; 99.75% similarity). Our results show that the populations in China and Korea are closely related to those in New Zealand, and all Asian populations may have the same origin.

Biotic invasions pose major threats to agriculture, forestry, natural environments, and public health. With the globalization of the world's economy and a drastic increase of human activities, the number of invasive species is also increasing [32]. Scolytines feature prominently among invasive species because they are easily transported through international trade inside wooden products and wood packaging materials in which they are concealed and protected [33,34]. Between 2003 to 2016, *H. ligniperda* was the second most frequently intercepted scolytine in ports of China, with 10,199 interceptions [35]. A worldwide survey of pine bark beetles on several continents also indicated that *H. ligniperda* was one of the most abundant and widespread invasive species [36]. Considering that there are several big ports managing timber import in Shandong, it is possible that *H. ligniperda* invaded China through international timber trade or contaminated wooden packages. However, it cannot be ruled out that it naturally spread to Shandong province through South Korea as the distance between both is only 310 km. The molecular tools in this survey show an identical match for COI between the China and South Korean samples. While important, it should be noted this result is based on a limited sample size (n = 5). More precise genetics methods, such as Single-nucleotide polymorphisms (SNPs) on specimens collected from the invaded areas and native ones, would help to clarify the invasive process and pathways.

Hylurgus ligniperda was first recorded in New Zealand in 1974. Three years later, it was found throughout New Zealand, including travelling between the two main islands [2]. To date, *H. ligniperda* has been one of the most highly abundant exotic wood borers and bark beetles in New Zealand [37]. Chase and Kelly [38] noted that the contributing factors to *H. ligniperda's* invasion success could be their effective long-distance dispersal, and it can mate with siblings before dispersal to increase the probability of colonization success. The rapid spread also occurred in other introduced areas, such as Japan, South Africa, and South America [12]. The survey data show that *H. ligniperda* spread rapidly in South Korea between 2010 and 2019. Unfortunately, the recent survey area of *H. ligniperda* in China is

only limited to some parts of Shandong Province. The local government is eager to control and investigate it in more regions. Given the number of localities already occupied by the species in China, it can be considered established.

Wood and Bright [9] recorded *H. ligniperda* from "Manchuria" in China. Historically, "Manchuria" has often referred to Northeast China, including three provinces of Heilongjiang, Jilin, and Liaoning, as well as the current border area with Russia. "Manchuria" has also been called "Guandong" in Chinese. We speculate that this is the origin of the CABI's misquotation "Guangdong is present", because there is no record of the occurrence of *H. ligniperda* in "Guangdong" in the CABI reference list and other literature. Tsai and Li [39] recorded 86 species of Scolytinae in North China (include Northeast China) and no record of *H. ligniperda.* In Northeast China. Yin et al. [40] conducted many field investigations beginning in 1955, of which they published a monograph "Economic Insect Fauna of China Fasc. 29 Coleoptera: Scolytidae" in 1984, which recorded 165 species of Scolytinae in China and no record of *H. ligniperda*. Song et al. [41,42] conducted investigations in several provinces between 1982 and 1995 and recorded 98 species of Scolytinae in Liaoning. Similarly, no records of *H. ligniperda* were made. For other areas in China, there are three rounds of nationwide forest survey in China from 1979 to 2019. *H. ligniperda* was never reported. After reviewing the literature and inspecting the specimens in the National Animal Collection Resource Center [previously the National Zoological Museum of China, Institute of Zoology (IOZ), Beijing, China], we did not find any collection of *H. ligniperda* in China before 2019. Also, this beetle is not found in eastern Russia (Alex Petrov, personal communication). So, the occurrence record of *H. ligniperda* in "Manchuria" China [9] is likely erroneous due to difficulties in translation or a record of an adventive specimen intercepted at a port.

In recent years, several economically significant Scolytinae invaded China, such as *Dendroctonus valens* (LeConte, 1860), *Xyleborus affinis* (Eichhoff, 1868), *Xyleborus ferrugineus* (Fabricius, 1801), *Hypothenemus hampei* (Ferrari, 1867), *Ips calligraphus* (Germar, 1824), and *Ips grandicollis* (Eichhoff, 1868) [43–47]. Many of the recent invasions are attributed to the increased global trade in timber, as China has become the second largest timber importer in the world [48]. There are likely more invasive scolytines yet to be detected or intercepted in China. It is urgent to carry out a national surveillance program for invasive scolytines in China, which can provide the basis for subsequent prevention and control.

4. Conclusions

Investigation and analysis showed that the previous record of the occurrence of *H. ligniperda* in China was likely misplaced; new observations suggest it has recently invaded and successfully colonized parts of Shandong Province, China. In South Korea, it has spread rapidly in recent years, and its current distribution effectively covers the majority of South Korea. In Japan, its distribution has covered the entirety of Honshu Island due to decades of colonization. The reporting of the East Asian invasion by *H. ligniperda* has been confused by semantic issues. More measures should be taken to control the rapid spread of this pest in Asia.

Supplementary Materials: The following are available online at https://www.mdpi.com/article/10.3390/f12070950/s1, Table S1: Records of *Hylurgus ligniperda* in East Asia.

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References

1. USDA-FS. *New Introduction: The Red-Haired Bark Beetle, Hylurgus ligniperda Fabricius (Coleoptera: Scolytidae). Pest Alert NA-PR-03-02*; United States Department of Agriculture: Morgantown, WV, USA, 2002; 2p.
2. Clare, G.K.; George, E.M. Life cycle and massrearing of *Hylurgus ligniperda* using a novel egg collection method. *N. Z. Plant Prot.* **2016**, *69*, 143–152.
3. Tribe, G.D. Phenology of *Pinus radiata* log colonization by the red-haired pine bark beetle *Hylurgus ligniperda* (Fabricius) (Coleoptera: Scolytidae) in the south-western Cape Province. *J. Entomol. Soc. South. Afr.* **1991**, *54*, 1–7.
4. Ciesla, W.M. Pine bark beetles: A new pest management challenge for Chilean foresters. *J. For.* **1988**, *86*, 27–31.
5. Kerr, J.L. Olfactory and Vvisual Cues in Host Finding by Bark Beetles. Master's Thesis, University of Canterbury, Christchurch, New Zealand, 2010.
6. Mausel, D.L.; Gara, R.I.; Lanfranco, D.; Ruiz, C.; Ide, S.; Azat, R. The introduced bark beetles *Hylurgus ligniperda* and *Hylastes ater* (Coleoptera: Scolytidae) in Chile: Seasonal flight and effect of *Pinus radiata* log placement on colonization. *Can. J. For. Res.* **2006**, *37*, 156–169. [CrossRef]
7. Wingfield, M.J. *Leptographium* spp. as root pathogens on conifers. An international perspective. In *Leptographium Root Diseases on Conifers*; APS Press: Eagan, MN, USA, 1988; pp. 113–128.
8. Kim, S.; Harrington, T.C.; Lee, J.C.; Seybold, S.J. *Leptographium tereforme* sp. nov. and other Ophiostomatales isolated from the root-feeding bark beetle *Hylurgus ligniperda* in California. *Mycologia* **2011**, *103*, 152–163. [CrossRef] [PubMed]
9. Wood, S.L.; Bright, D.E. A catalog of Scolytidae and Platypodidae (Coleoptera), Part 2. *Taxonomic Index. Great Basin Natur. Mem.* **1992**, *13*, 1–1553.
10. Wood, S.L. *Bark and Ambrosia Beetles of South America (Coleoptera: Scolytidae)*; Bean Life Science Museum: Provo, UT, USA, 2007; 900p.
11. Park, S.; Jung, J.C.; Han, T. A new species and five newly recorded species of Scolytinae (Coleoptera: Curculionidae) from Korea. *Entomol. Res. Bull.* **2017**, *33*, 131–137.
12. CABI. *Hylurgus Ligniperda* (Red-Haired Pine Bark Beetle). Available online: https://www.cabi.org/isc/datasheet/27364#A273D0F3-9A90-4AB2-8CFF-67016823E9DF (accessed on 8 March 2021).
13. Hoebeke, E.R. *Hylurgus ligniperda*: A new exotic pine bark beetle in the United States. *Newsl. Mich. Entomol. Soc.* **2001**, *46*, 1–2.
14. Liao, L.; Xu, M.; Zhang, W.; Chi, Y.; Huang, G. Using DNA barcodes to identify two morphologically alike species: The cotton bollworm and corn earworm. *Plant Quar.* **2012**, *26*, 12–16.
15. Albo, J.E.; Marelli, J.P.; Puig, A.S. Rapid molecular identification of Scolytinae (Coleoptera: Curculionidae). *Int. J. Mol. Sci.* **2019**, *20*, 5944. [CrossRef]
16. Sequeira, A.S.; Normark, B.B.; Farrell, B.D. Evolutionary assembly of the conifer fauna: Distinguishing ancient from recent associations in bark beetles. *Proc. R. Soc. Lond. B Biol. Sci.* **2000**, *26*, 2359–2366. [CrossRef]
17. Choo, H.Y.; Woo, K.S. A list of Korean bark and ambrosia beetles, and their host plants. *Korean J. Plant Prot.* **1985**, *24*, 163–167.
18. Choo, H.Y.; Woo, K.S. Supplementary notes on the bark and ambrosia beetles of Korea. *Korean J. Appl. Entomol.* **1989**, *28*, 4–9.
19. Murayama, J. Notes sur les Scolytides de Honshu et Kyushu, Japon. *Tenthredo* **1936**, *1*, 121–149. (In French)
20. Ohara, M. Insect specimens of Hokkaido University. Version 1.3. National Museum of Nature and Science, Japan. Occurrence Dataset. Available online: https://www.gbif.org/occurrence/search?q=Hylurgus%20ligniperda&country=JP (accessed on 28 December 2020).
21. Kabe, M. *Scolytid: On the Hosts and Habitats of the Scolytid and Platypodid-Beetles in Japan*; Maebashi Regional Forest Office: Gunma, Japan, 1960; pp. 8–9. (In Japanese)
22. Inoue, M. *Ipidae: A Detailed Book of the Forest Insect Control II*; Chikyu Publishing Kabushiki Gaisha: Tokyo, Japan, 1953; p. 179. (In Japanese)
23. Nakada, M. *Coleoptera: Insect in Nose Town, Japan*; Nakada Motoaki: Hyogo, Japan, 1970; p. 107. (In Japanese)
24. Matsueda, A. Distribution of *Monochamus alternatus* and *Bursaphelenchus lignicolus* in Ishikawa Prefecture. *Bull. Ishikawa-Ken Exp. Stn.* **1975**, *6*, 43–62. (In Japanese)
25. Nohira, T.; Ogawa, S. Scolytidae (Coleoptera) collected by chemical traps for Matsukuimushi. *J. Jpn. For. Soc.* **1986**, *68*, 249–250. (In Japanese)
26. Yamada, A.; Kawasaki, K.; Morimoto, N.; Masuzawa, T. An analysis of species composition of insects attracted by the trap in three different areas, with special reference to the "pine bark beetles". *Bull. Environ. Conserv.* **1986**, *8*, 39–43. (In Japanese)
27. Kinuura, H.; Makihara, H. Scolytid beetles captured by black hanging traps with attracting chemicals from the Takizawa Experimental Forest of Iwate University Northeast Honshu, Japan (Coleoptera: Platypodidae and Scolytidae). *Bull. Iwate Univ. For.* **1994**, *25*, 67–78. (In Japanese)

28. Takahashi, I. Some Scolytid ambrosia beetles attacking Japanease Pear. *Plant Prot.* **2006**, *60*, 62–66. (In Japanese)
29. Niisima, Y. On some Japanese Species of the Scolytini. *J. Sapporo Agric. Coll.* **1905**, *2*, 67–74.
30. Niisima, Y. Die Borkenkafer nord- und mittel-Japans. *Sapporo Nat. Hist. Soc. Trans.* **1910**, *3*, 1–18.
31. Murayama, J. Revision des Coleopteres des Ipines avec la description d'une nouvelle espece. *J. Chosen Nat. Hist. Soc.* **1929**, *9*, 22–30, (In Japanese, French summary).
32. Meyerson, L.A.; Mooney, H.A. Invasive alien species in an era of globalization. *Front. Ecol. Environ.* **2007**, *5*, 199–208. [CrossRef]
33. Haack, R.A. Intercepted Scolytidae (Coleoptera) at US ports of entry: 1985–2000. *Integr. Pest Manag. Rev.* **2001**, *6*, 253–282. [CrossRef]
34. Brockerhoff, E.G.; Bain, J.; Kimberley, M.; Knížek, M. Interception frequency of exotic bark and ambrosia beetles (Coleoptera: Scolytinae) and relationship with establishment in New Zealand and worldwide. *Can. J. For. Res.* **2006**, *36*, 289–298. [CrossRef]
35. Wang, K.; Xu, M.L.; Liu, P.H.; Li, L.J.; Gao, R.H.; Wang, J. Interception situation and suggestion of Scolytidae at China ports. *Plant Quar.* **2018**, *32*, 65–68. (In Chinese)
36. Faccoli, M.; Gallego, D.; Branco, M.; Brockerhoff, E.G.; Corley, J.; Coyle, D.R.; Hurley, B.P.; Jactel, H.; Lakatos, F.; Lantschner, V.; et al. A first worldwide multispecies survey of invasive Mediterranean pine bark beetles (Coleoptera: Curculionidae, Scolytinae). *Biol. Invasions* **2020**, *22*, 1–15. [CrossRef]
37. Brockerhoff, E.G.; Jones, D.C.; Kimberley, M.O.; Suckling, D.M.; Donaldson, T. Nationwide survey for invasive wood-boring and bark beetles (Coleoptera) using traps baited with pheromones and kairomones. *For. Ecol. Manag.* **2006**, *228*, 234–240. [CrossRef]
38. Chase, K.D.; Kelly, D.; Liebhold, A.M.; Bader, M.K.; Brockerhoff, E.G. Long-distance dispersal of non-native pine bark beetles from host resources. *Ecol. Entomol.* **2017**, *42*, 173–183. [CrossRef]
39. Tsai, P.H.; Li, C.L. A preliminary faunistic survey of the Scolytidae in North China. *Opera Entomol.* **1959**, 73–117. (In Chinese)
40. Yin, H.F.; Huang, F.S.; Li, Z.L. *Economic Insect Fauna of China. Fasc 29. Coleoptera: Scolytidae*; Science Press: Beijing, China, 1984; 205p. (In Chinese)
41. Song, Y.W.; Wang, D.H.; Zhang, S.W.; Shan, L.H.; Zhang, D.S.; Yang, W.Y.; Zhao, Y.R. Catalogue of bark beetles in Liaoning province (I). *J. Liaoning For. Sci. Technol.* **1998**, *1*, 23–25. (In Chinese)
42. Song, Y.W.; Wang, D.H.; Zhang, S.W.; Shan, L.H.; Zhang, D.S.; Yang, W.Y.; Zhao, Y.R. Catalogue of bark beetles in Liaoning province (II). *J. Liaoning For. Sci. Technol.* **1998**, *4*, 25–37. (In Chinese)
43. Cognato, A.I.; Sun, J.H.; Anducho-Reyes, M.A.; Owen, D.R. Genetic variation and origin of red turpentine beetle (*Dendroctonus valens* LeConte) introduced to the People's Republic of China. *Agr. For. Entomol.* **2005**, *7*, 87–94. [CrossRef]
44. Smith, S.M.; Beaver, R.A.; Cognato, A.I. A monograph of the Xyleborini (Coleoptera, Curculionidae, Scolytinae) of the Indochinese Peninsula (except Malaysia) and China. *ZooKeys* **2020**, *983*, 1–442. [CrossRef] [PubMed]
45. Lin, W.; Xu, M.F.; Gao, L.; Ruan, Y.; Lai, S.; Xu, Y.; Li, Y. New records of two invasive ambrosia beetles (Curculionidae: Scolytinae: Xyleborini) to mainland China. *BioInvasions Rec.* **2021**, *10*, 74–80. [CrossRef]
46. Sun, S.W.; Wang, Z.; Liu, A.; Lai, S.C.; Wang, J.G.; Meng, Q.Q.; Guo, Y.F.; Andrew, J.J.; Li, Y. First Record of the Coffee Berry Borer, *Hypothenemus hampei* (Ferrari) (Coleoptera: Curculionidae: Scolytinae) on Hainan Island, China. *Coleopt. Bull.* **2020**, *74*, 710–713. [CrossRef]
47. Li, Y.; Johnson, A.J.; Gao, L.; Wu, C.; Hulcr, J. Two new invasive *Ips* bark beetles (Coleoptera: Curculionidae) in mainland China and their potential distribution in Asia. *Pest Manag. Sci.* **2021**. [CrossRef] [PubMed]
48. Zhang, J.; Yang, J.; Yi, J. Structure analysis and suggestions of China timber imports. *World J. For.* **2019**, *8*, 129–136.